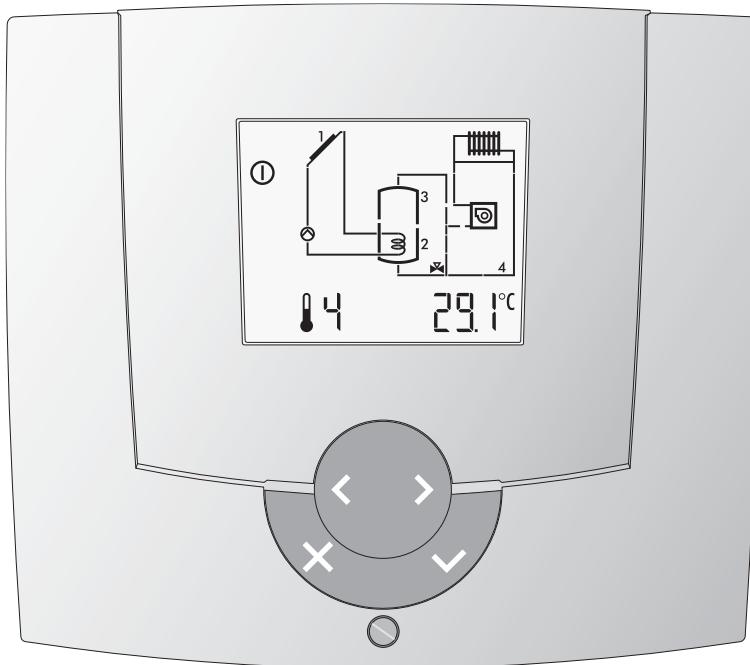


Solar Energy Controller DC 12



Operating instructions

Contents



Warning

The controller is an electrically operated device. Improper installation or attempted repair can cause a life-threatening electric shock hazard. Installation and commissioning must be performed only by adequately qualified specialist personnel.

There are no user serviceable parts inside. Do not open the controller except to mount it and fit sensors and then only do so when it is disconnected and in accordance with these instructions.

When the controller is open, the printed circuit must be handled with utmost care. Mechanical damage and any magnetic or static charge from tools must be avoided.

Repairs may only be carried out by the manufacturer.

Explanation of terms and abbreviations; page 34

Symbols

Instructions that are marked by a warning symbol must be always observed.



Attention danger by voltage.



Important things to note.

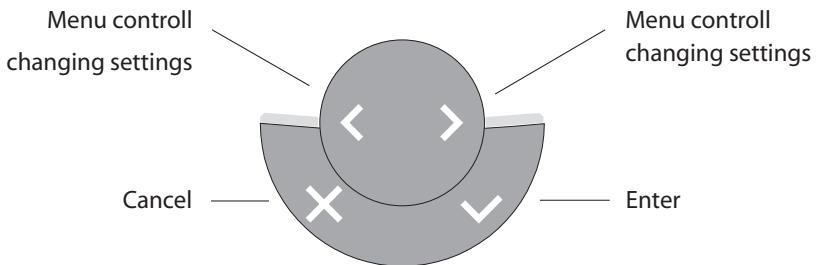
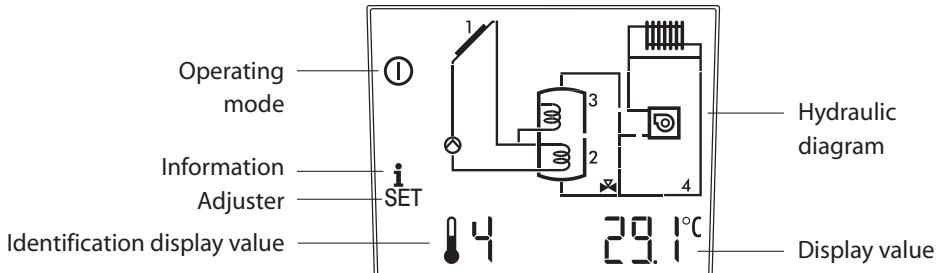


Reference / explanation

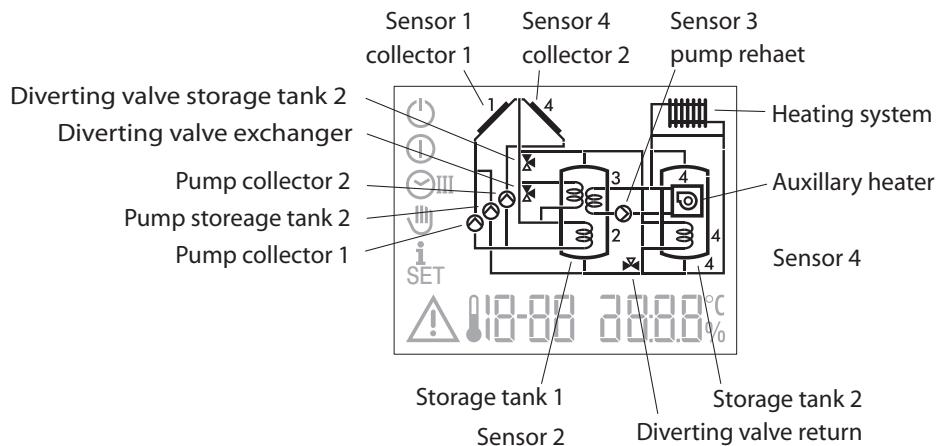
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Display and controls

Overview of display



Display with all segments



Note:

1 Operation

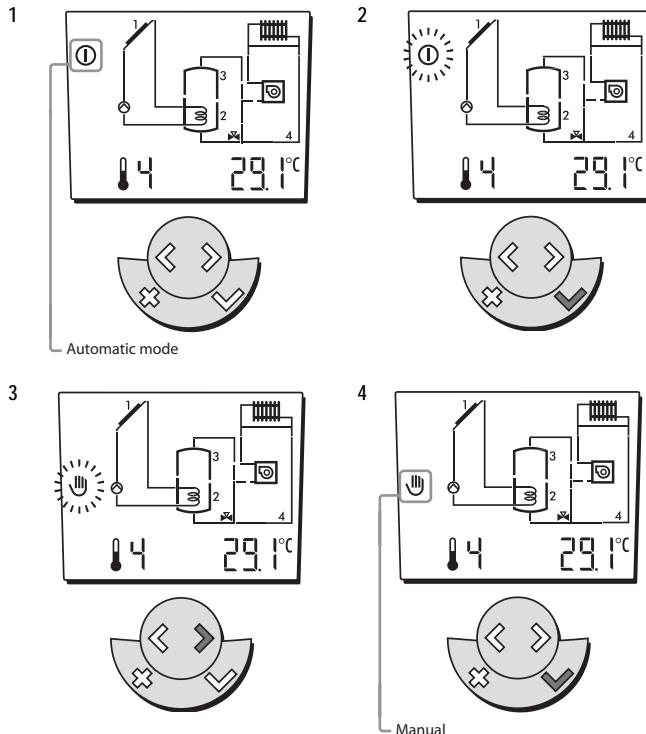
1.1 How to change operating modes



You can select automatic or manual operating by using the enter key and the settings keys.

Example:

1. when the controller is in *automatic mode* the symbol is
2. To change the operating mode to *manual*, press the enter key. The operating mode now flashes.
3. Press the settings key to select the operating mode *manual* until the symbol flashes.
4. Press the enter key . The controller is now in *manual* operating mode and the symbol is lit.



Operating modes:

Standby

- System off, only the protective functions are active

Automatic mode

- The controller functions are active according to the selected hydraulic variant and settings

Manual

- The functions can be tested and adjusted manually

When changing operating modes you may press the cancel key before you have pressed the enter key and the controller will then revert to the previous operating mode.

The information menu enables you to look at information about the solar system. You can see actual temperatures, and the way in which the system is operating.

Example:

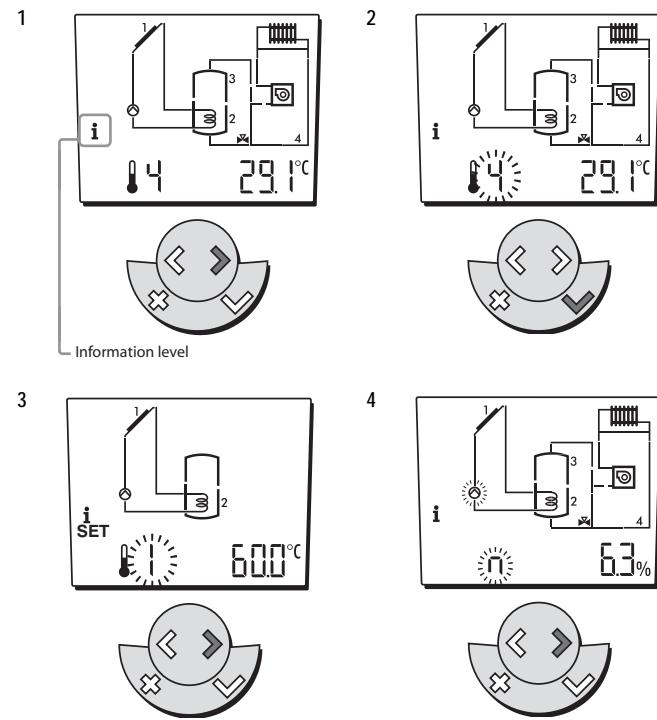
1. To enter the information menu, press the settings  key until the symbol  appears.

2. To look at the data, press the enter  key.
A value flashes on the display.

3. By pressing the settings  key, the temperature values and operating data can seen in succession.

When the symbol  appears on the display the controller is indicating the set point of the temperature value.

4. When you look at the data you will see the relevant part of the schematic flashing and it is corresponding function setting flashing.



Display	Description	Unit
 	Measured temperature value	°C
 	Set point of temperature	°C
 	Highest collector temperature in a 24 hour period	°C
	Collector pump speed	%
	Reheating pump relay, generator pump or diverter valve	-
	Collector capacity	-
	Collector yield	-
	Information	-

After 2 minutes without a being entered the controller reverts back to its actual operating mode.

Pressing the cancel  key enable you to exit the information menu. The controller reverts to its actual operating mode and settings.

In order to program the controller you must enter the settings menu.

Example:

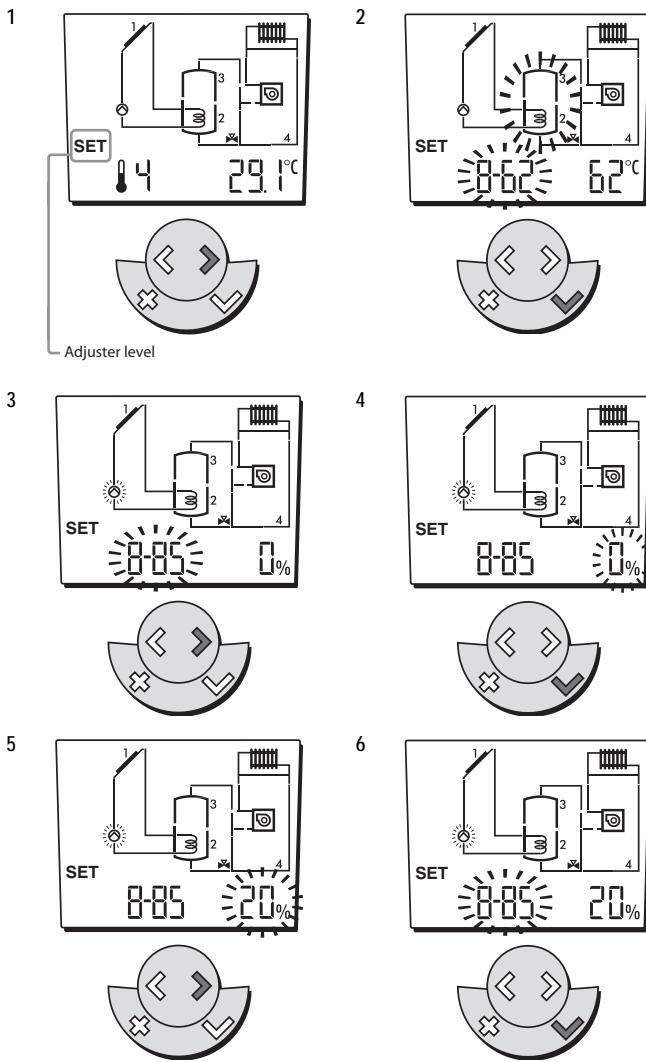
1. To enter the settings menu, press the settings  key so often, until the symbol **SET** appears.
2. To view the settings, press the enter  key. The first setting and its function flashing on the display.
3. By pressing the settings   keys, the various settings can be viewed in succession.
4. Press the enter  key to stay on to the appropriate sub menu of the value you wish to change.

5. By pressing the settings   keys the value of setting can be changed.
6. Press the enter  key to save the changed value.

💡 Press the cancel  key once and the controller reverts to the previous sub menu, press once more and it exits the menu.

The following adjusters are shown:

- 8-56 Priority tank1
- 8-62 Set temperature tank 1, normal
- 8-63 Differentials for temperature tank 1
- 8-56 Priority tank 2
- 8-62 Set temperature tank 2, normal
- 8-63 Differentials for temperature tank 2
- 8-85 Setting value collector pump 1 ()
- 8-85 Setting value collector pump 2 ()
- 8-86 Setting value circulation pump ()
- 8-87 Setting value diverter valve ()



💡 After 2 minutes without a being entered the controller reverts back to its actual operating mode.

💡 Pressing the cancel  key able you to exit the settings menu. The controller reverts to its actual operating mode and settings.

Adju- ster	Hy- draulic	Function	Setting range	Factory setting	Unit	Basic setting Dat.:	Revised Dat.:
8-62	all	Set temperature 1, normal	0÷90	60	°C		
		<p>This enables you to set a set point temperature for the first circuit sensor. If the circuit is a hot water cylinder then the maximum temperature will be set at the point at which the sensor contact enters the cylinder. The thermal circuit will only charge up to the value set here. Once this temperature is reached the thermal circuit will switch off, regardless of the solar energy available.</p> <p>💡 Basic target set value for calculation of the optimised over-increase of the number of revolutions during charging is set value.</p>					
8-63	all	Setting temperature differentials for thermal circuit 1	1÷30	2	K		
		<p>The temperature set in menu 8-62 above less the value set in this menu provides a temperature at which the solar system will start to heat the thermal circuit and commence heat exchange. Temperature within the differential do not operate to send an instruction to start heating the circuit. If the differential is set to low, then the pump will frequently switch on and off, reducing the overall efficiency of the system.</p>					
8-85	all	Setting value collector pump 1, in manual operation	0÷100	0	%		
		<p>In manual operation ⚙ a setting can be entered here.</p>					

1.5 Changes that need an access code (expert level)

SET [Cod] --

Certain changes should only be made by experts and are therefore this menu is protected by an access code.

Example:

1. To enter the expert menu keeping pressing the settings  key so often, until the symbol **SET** appears.

2. To view the expert menu, press the enter  key. The first item that may be adjusted and its function flashes.

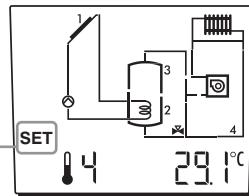
3. Keep pressing the settings  key, until "Cod --" appears.

4. Press the enter  key to enter the code.

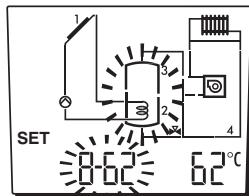
5. Enter the access code ("25") with the settings   keys.

6. Confirm the code with the enter  key.

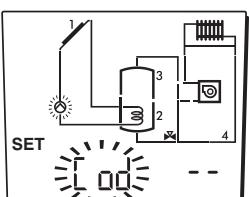
1



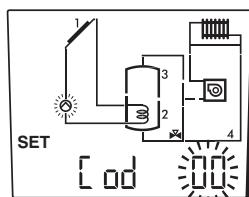
2



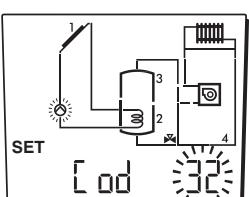
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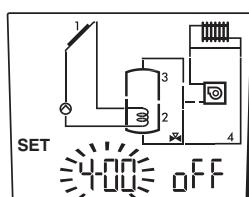
4



5



6



ⓘ After 2 minutes without a being entered the controller reverts back to its actual operating mode.

ⓘ Pressing the cancel  key anable you to exit the expert menu. The controller reverts to its actual operating mode and settings.

Adjuster	Hydraulic	Function	Setting range	Factory setting	Unit	Basic setting Dat.:	Revised Dat.:
04-06	all	Hydraulic variants	1÷1	1	-		
		Hydraulic variant 1 = Speed (rpm) controlled collector pump on tank (SP) 1					
04-20	all	eBUS-Addressing	1÷16	16	-		
		Only ES 5911, not in use: Addressing the controller in eBUS combination. 16 standard master addresses.					
04-36	all	eBUS-charging	on/off	off	-		
		Only ES 5911, not in use: On = eBUS charging by solar controller activated Off = eBUS charging by solar controller deactivated, is carried out by another controller in the eBUS combination.					
05-04	all	Legionella protection temperature	60÷80	60	°C		
		Set value for the thermal pasteurisation (Legionella protection). Tjis is the temperature at which heat treatment of a water store as a contra legionella takes place. Not in use!					
05-14	all	Legionella protection function	0÷9	0	-		
		You may specify when and how often the legionella protection function is carried out. (protective temperature as per Adjuster 5-04) 0 = never 1 = Once each week 8 = Once every day 9 = Always Not in use!					
08-01	all	Increase collector tank for charging ON	0÷50	15	K		
		If the temp. at the collector sensor is higher than the temp. on the tank sensor + set value "08-01" solar charging is enabled.					
08-02	all	Increase collector tank for charging OFF	0÷50	5	K		
		If the temp. at the collector sensor is less than the temp. at the tank sensor + set value "08-02", solar charging is disabled.					

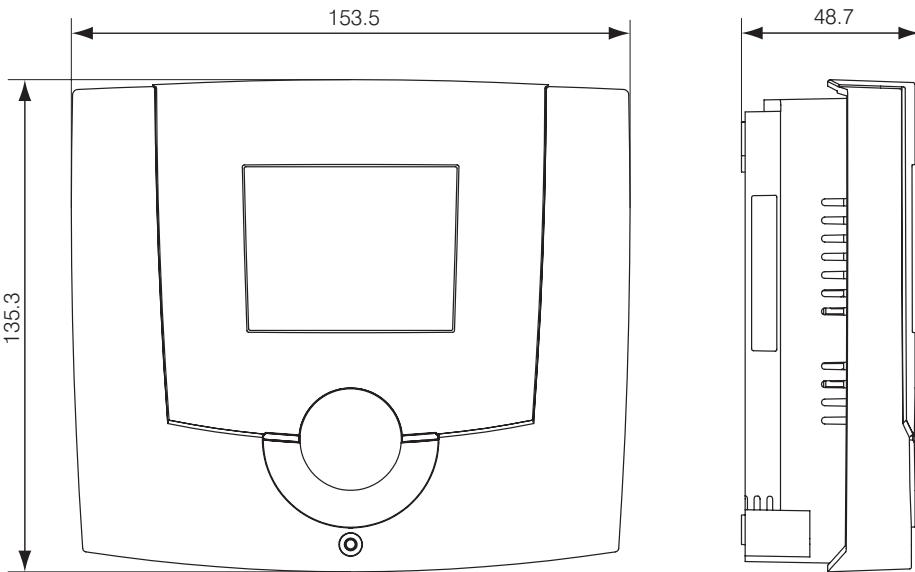
Adju- ster	Hy- draulic	Function	Setting range	Factory setting	Unit	Basic setting Dat.:	Adaptation Dat.:
08-15	all	Start-up help	on/off	on	-		
		In some systems the collector temperature may not be properly recorded on start up. In the "on" position a start up programm for the pump is activated enabling a very accurate reading to be taken by the sensor. In this programm the solar pump switches on for 30 seconds and then the pump switches off. The temperature at the collector is measured immediately. If the temperature difference is sufficient, the solar pump switches on. If the switching - on - conditions are not reached, the solar pump becomes switched on again, after a variable period of time (between 15 minutes and 100 minutes) for another period of 30 seconds.					
		The variable period is set by the conditions of the actual collector temperature and the temperature changes.					
08-20	all	P range (Xp) collector controller pump steering	10÷50	20	K		
		The collector controller has a PID control. The set P range determines at which set value deviation 100% adjusting command for the speed control is generated.					
08-21	all	Response time (Tn) collector controllers	0÷30	10	min		
		The response time influences the speed with which the speed control adjusts a deviation between set and actual values. The setting determines after how many minutes the double value of the difference from the minimum setting value (08-35) is demanded.					
08-22	all	Derivative time (Tv) collector controller	0÷10	0	min		
		With the derivative time, a differential share can be allocated to the speed control. The actual increase of the collector temp. multiplied by the derivative time gives the change in setting for the speed control.					
		With the derivative time, the controller makes a forecast of the deviation from the set temperature and corrects the expected deviation correspondingly, i.e. it makes the correction before the deviation from the set value has developed. Time horizon of the forecast = derivative time.					
08-30	all	Solar nominal performance collector 1	1÷50	8	kW		
		Solar nominal performance is based on the actual panel performance taking the flow settings (08-37) into account. This value is used to calculate the relative solar performance. During solar charging the actual solar performance ($n \times c \times V \times dT$) is compared to the nominal performance. Depending on the actual panel performance the controller will modulate the pump speed and controller flow, thus increasing the performance and efficiency of the solar system.					
		With the derivative time, the controller makes a forecast of the deviation from the set temperature and corrects the expected deviation correspondingly, i.e. it makes the correction before the deviation from the set value has developed. Time horizon of the forecast = derivative time.					
		To calculate the solar nominal performance in your system, you can take 0.6 kW per square meter of collector.					
		Note: n = actual set value c = heat capacity medium collector circuit (8-09) V = volume at 100% speed (8-37) T = temperature difference collector B1 / tank B2					
08-35	all	Min. set value collector pump 1	5÷100	50	%		
		Minimum set value for the speed control of the collector pump 1					

Adju- ster	Hy- draulic	Function	Setting range	Factory setting	Unit	Basic setting Dat.:	Adaptation Dat.:
08-37	all	Volume flow coll. pump 1 at 100% set value	1-50	2	l/min		
		The volume flow at 100% set value of the pump collector 1 and aligned hydraulic. ☀ To calculate the volume flow in your system, you can take 1 l/min per collector. ☀ In manual operating mode set Adjuster 8-85 to 100%. Read the through-flow at the floating body volume flow meter.					
08-50	all	Strategy solar charging	0-4	3	-		
		A basic strategy can be selected for solar charging: Note: In the charging strategy it is attempted to charge the tank to the required set or maximum value with as few charging cycles as possible. Based on the available solar energy, the controller attempts to maintain an even increase at the collector sensor throughout the whole charging time. This optimised increase has a lower limit (Adjuster 8-64). In the strategies 3 + 4 this calculation is only used with high solar energy levels.					
		0 = Parallel charging				Charging in an alternating operation, the lowest tank is charged first. The set value for the speed control is determined from the temperature at the tank sensor + increase (Adjuster 8-64)	
		1 = Set charging				Charging is carried out to the set value according to priority of the tank (Adjuster 8-56). The tank with priority 1 is charged first to the set value (Adjuster 8-62). The set value for the speed control is determined from the temperature at the tank sensor + optimised increase.	
		2 = Maximum charging				Charging is carried out to the maximum value according to priority of the tank (Adjuster 8-56). The tank with priority 1 is charged first up to the maximum value (Adjuster 8-59). The set value for the speed control is determined by the maximum value + optimised increase (Adjuster 8-64)	
		3 = Set charging dependent on energy				Charging is carried out to the set value according to energy available (Adjuster 8-51) parallel in alternating operation or according to priority of the tank (Adjuster 8-56). The set value for the speed control is determined according to the active strategy.	
		4 = Maximum charging dependent on energy				Charging is carried out to the maximum value according to the energy available (Adjuster 8-51) parallel in alternating operation or according to priority of the tank (Adjuster 8-56). The set value for the speed control is determined according to the active strategy.	
08-51	all	Change-over solar charging (high energy levels)	30-100	50	%		
		If the comparison of actual solar energy with the nominal performance gives a factor which lies above the setting value, a change-over from parallel operation (alternating) to set value or maximum charging takes place. ☀ The basic settings for the nominal solar performance (E8-30) are directly linked and must be correctly set.					

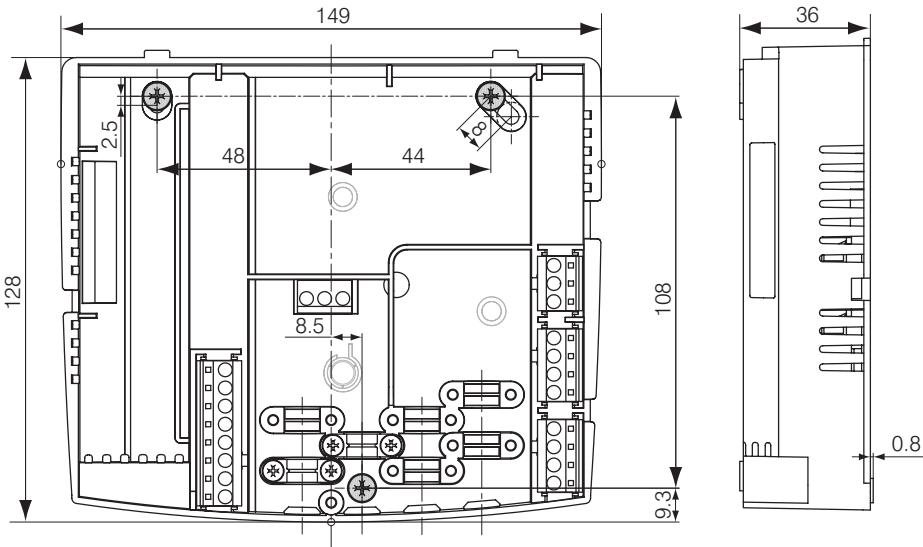
Adju- ster	Hy- draulic	Function	Setting range	Factory setting	Unit	Basic setting Dat.:	Adaptation Dat.:
08-55	all	Tank type, tank 1 0 = Hot water tank	0÷4	0	-		
		2 = Heating tank			All charging strategies are possible. According to application, the settings for the change-over to alternating operation must be adjusted. (Adjuster 8-65 and Adjuster 8-66)		
		4 = Swimming pool			If the tank set value is set below 20°C, this is understood to be summer operation. The tank set value will be lowered to the frost temperature of 10 °C.		
					Not included in alternating operation		
08-59	all	Maximum temperature, tank 1	10÷90	80	°C		
		If the temp. at the tank sensor rises above the set value, solar charging for this tank is disabled. With active overheating protection (Adjuster 8-05) this limiting value is ignored.					
08-60	all	Protective temperature tank 1	10÷95	90	°C		
		If the temp. at the tank sensor rises above the set value, solar charging is disabled, even if the overheating protection is active.					
08-64	all	Set value charging temperature increase, tank 1	5÷50	20	K		
		Minimum increase which is demanded at the collector sensor for charging. This increase always refers to the tank sensor.					

2 Dimensions and assembly

2.1 Dimensions DC 12



2.2 Dimensions of the basic housing DC 12



2.3 Assembly DC 12

Determination of position of mounting

The solar controller ES 5910/11 S is to be placed closely at the solar heating circle, so that a short wiring way is made possible.

Open the controller for the assembly and wiring

So that the controller base can be installed and wired, first it must be dismounted.

1. Loosen the screw of the front cover.
2. Take off the front cover.
3. With a screwdriver lift the base from the controller-print, see illustration right.

Mounting of the controller base

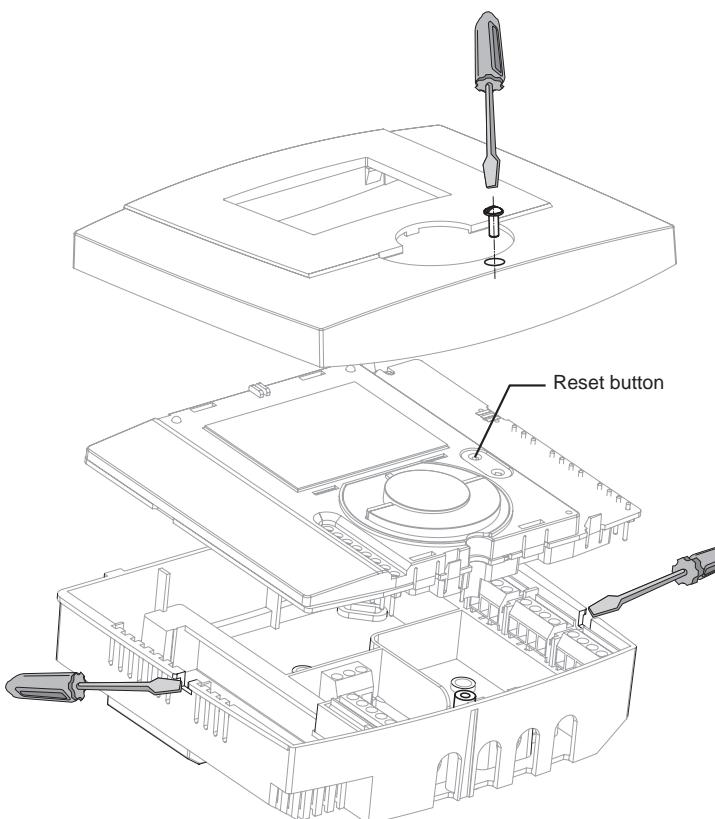
The controller base of the ES 5910/11 S has to be mounted with 3 screws.

1. Hold the controller base to the assembly place and mark with an indication pin the mounting holes.
2. Drill the mounting holes and provide them with pegs.
3. Place the controller base, fit the screws (do not tighten), align the base, then drive the mounting screws fully home.

Now the controller can be attached electrically, see chapter 3.1, page 16.

Installation and set-up instructions

- Electrical installation and fuse protection must comply with local regulations.
- The ES 5910/11 S must be powered continuously, to ensure operation at all times.
- Upstream switchgear should therefore be limited to emergency or main switches that are permanently "on".
- Before putting the controller into operation, check all electrical connections to the various system components.
- It may be necessary to electrically suppress strongly inductive loads in the vicinity of the controller (contactors, solenoid-operated valves, etc.). This can be done by connecting RC circuit directly to the coil terminals of the disturbing components. Recommended RC circuit: 0.047fÉF, 100, , rated at 250 VAC (e.g. Bosch, RIFA, etc.).



💡 Open the front cover to make a restart. To make a Restart of the controller push the reset button.



The connections main voltage on the left side No. 1-3/LN are loaded with 230 V. These clamps may be affected only dead, otherwise mortal danger exists because of current impact.

3.1 Electrical connection allocation ➔

Check up before start up if:

- the plant-main-switch (if existing) is switched on!
- the controller is switched on!
- the correctly hydraulic variant is selected (Adjuster 4-06)
- the temperature set points values are o.k.!
- the temperatures of the connected sensors are shown on the display, and there values are plausibly!
- a charge enterprise is possible do to the collector temperature/storage tank temperature!

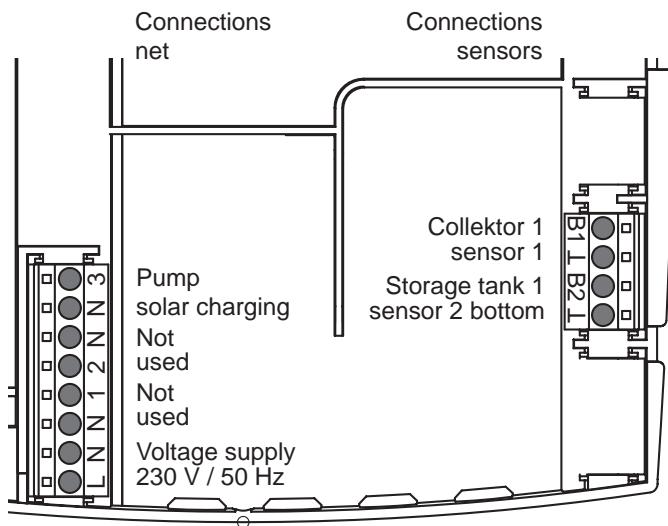
Checking the controller

In order to test the controller and the appropriate mechanism, the following clarifications can be accomplished after switching on the DC 12:

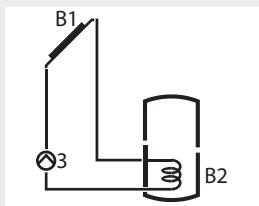
1. All the segments are displayed briefly (page 3)
1. The software number appears (p. e. SW 1.4)

If the controller display then reverts to normal, the internal function test was successful.

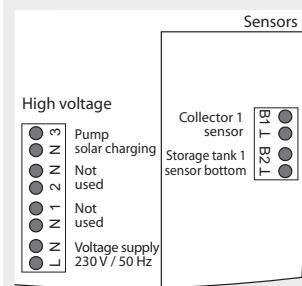
Example: Hydraulic variant 1



Solar charging of tank 1.
(Tank type can be chosen, warm water/heating / swimming pool)



Connections hydraulic 1:



Code	Adjuster	Function	Setting range	Factory setting	Unit	Basic set. Dat.:
8-62		Set temperature tank 1, normal	0÷90	60	°C	
8-63		Setting temperature differentials for thermal circuit 1	1÷30	2	K	
8-85		Setting value collector pump 1, in manual operation	0÷100	0	%	
4-06		Hydraulic variants	1÷9	1	-	
4-20		Addressing of eBUS	1÷16	16	-	
4-36		eBUS charging	on/off	off	-	
5-04		Legionella protection temperature	60÷80	60	°C	
5-14		Legionella protection function	0÷9	0	-	
8-01		Increase collector tank for charging ON	0÷50	15	K	
8-02		Increase collector tank for charging OFF	0÷50	5	K	
8-15		Start-up help pipe collector	on/off	on	-	
8-20		P range (Xp) collector controller pump steering	10÷50	20	K	
8-21		Response time (Tn) collector controllers	0÷30	10	min	
8-22		Derivative time (Tv) collector controller	0÷10	0	min	
8-30		Solar nominal performance collector 1	1÷50	8	kW	
8-35		Min. set value collector pump 1	5÷100	50	%	
8-37		Volume flow coll. pump 1 at 100% set value	1÷50	2	l/min	
8-50		Basic strategy solar charging	0÷4	3	-	
8-51		Change-over solar charging (high energy levels)	30÷100	50	%	
8-55		Tank type, tank 1	0÷4	0	-	
8-59		Maximum temperature, tank 1	10÷90	80	°C	
8-60		Protective temperature tank 1	10÷95	90	°C	
8-64		Set value charging temperature increase, tank 1	5÷50	20	K	

💡 The adjusters with code 2 are valid for all hydraulic variants!

⚠ You receive the code 2 from your heating expert.

Adjuster	Function	Setting range	Factory setting	Unit	Basic set. Dat.:
8-05	Overheating protection	on/off	on	-	
	If the temperature at the collector rises above the set collector maximum temperature (Adjuster 8-11) with the overheating protection active, solar charging will be enabled independent of the set tank maximum temperature (Adjuster 8-59). The set value for the speed control is determined by the temperature on the tank sensor + setting value 8-64.				
	💡 If the collector protection temperature Adjuster 8-10 or the tank protective temperature (E8-60) is exceeded, solar charging is disabled.				
8-09	Special heat capacity collector fluid	on/off	4.1	kJ/kg K	
	Special heat capacity of the collector fluid according to manufacturer's specifications.				
8-10	Collector protective temperature	80÷130	130	°C	
	If the temperature at the collector sensor rises above the set value, solar charging is disabled.				
8-11	Collector maximum temperature	80÷130	95	°C	
	If the temperature at the collector sensor rises above the set values with the overheating protection active (Adjuster 8-05), solar charging is enabled.				
8-13	Frost protection function	-50÷10	-50	°C	
	Deactivated if the setting is -50°C.				
	Solar pump is switched on if the temperature at the collector sensor < setting - hysteresis.				
	Hysteresis 3 K is a given set value.				
8-90	Error threshold for pump feedback signal	0÷200	100	%	
	The pump can be controlled. The controller measures the phase displacement and compares it to the expected values.				
	💡 Only for controller ES 5910 P / 5911 P. Error check is only carried out at pump start-up.				
	0% = Only small deviations allowed				
	0 ÷ 199% = The larger the set value, the higher the allowed deviation				
	200% = Inactive, no pump error messages				
8-91	Max. temperature difference collector - tank	10÷80	50	K	
	If the difference in temperature between the collector and the tank temperature rises above the set value when solar charging is active during the set time (Adjuster 8-92), an error message (Err 61, 62, 63) is generated.				
8-92	Waiting period error message ΔT collector - tank	0÷180	30	min	
	If the difference in temperature between the collector and the tank temperature is too high when solar charging is active and during the set time, the error message is generated according to 8-91.				
	💡 0 = Error message disabled				

4 Troubleshooting

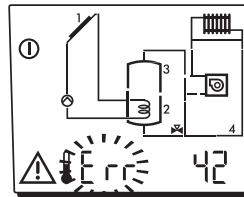
If after switching on, no display appears, or an error message appears, the clarifications in following table can be useful.

Statement	Possible cause	Solution
Display doesn't appear	Controller not under tension External switch is on position "Off"	Examine the fuse, set external switch to "ON"!
	Wiring defect	Open the controller and examine the wiring!

4.1 Error codes



Error-display

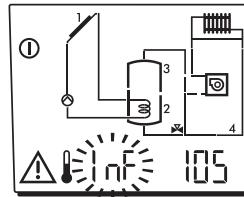


Error Code	Hydraulic	Description	Possible cause
41	all	Sensor 1 outside the measuring range.	Short circuit of sensor / cut out
42	all	Sensor 2 outside the measuring range.	Short circuit of sensor / cut out
53	all	Speed (revs.) of the pump does not correspond to the controller given figure. Note: With Adjuster 8-90 = 200, control OFF. (Only in controller DC 12 P)	Pump blocked!
61	all	Error when charging from collector 1 to tank 1 lower zone (temp. diff. collector-tank remains high) Note: With Adjuster 8-92 = 0, control OFF	No heat transfer, air in charging circuit, no hydraulic adjustment, outlet, pump defect



Info-display

The controller checks the system status and signals errors. This is a plausibility check of the data and serves to provide information when malfunctioning occurs.



Info code	Hydraulic	Description	Possible cause
101	all	Collector max. temp. > as the collector protection temp.	Wrong basic settings (A 8-11) > (A 8-10)
102	all	Increase collector tank for charging OFF > increase collector tank for charging ON- 2K	Wrong basic settings (A 8-02) > (A 8-01 - 2K)
105	all	Set temp. tank 1 normal > max. temp. tank 1	Wrong basic settings SP 1 (A 8-62) > (A 8-59)
107	all	Maximum temp. tank 1 > protection temp. tank 1	Wrong basic settings (A 8-59) > (A 8-60)

4.3 Temperature sensor resistance

Temperature °C	Resistance NTC 5 kΩ
-20	48'535
-15	36'475
-10	27'665
-5	21'165
0	16'325
5	12'695
10	9'950
15	7'855
20	6'245
25	5'000
30	4'029
40	2'663
50	1'802
60	1'244
70	876
80	628
90	458
100	339
105	294
110	255
115	223

5 Technical data

DESIGNATION / TYPE	DC 12						
Voltage supply	230 V AC \pm 10% 50 – 60 Hz						
Max. power input	2.3 VA						
Fuse	3.15 A						
OUTLETS							
Fully electronic relays	1						
SWITCHING CAPACITY							
Fully electronic relays	1 (1) A						
Inputs sensor	2						
Voltage, measuring circuit	12 V, V, protective insulation 4 kV						
HOUSING							
Montage	Wall mounting						
Dimensions H / W / D	153.5x135.3x48.7						
Display	LCD 96 Segment display						
Operation	4 push buttons						
Protection	IP 40 – EN 60529						
Protective class	II – EN 60730						
EMV	EN 50082-1						
EMV-Emission	EN 50081-1						
Ambient temperature	0 ... 50°C						
Hydraulic variants	1						
Tests	The controller is CE - conform according to the following EU guidelines: • 70/23/EWG "Low Voltage-Guideline" • 89/336/EWG "EMC guideline", including the amendment guidelines up to 90/68/EWG						

5.1 Explanation of terms and abbreviations

h	Hours
Actual value	Measured value/temperature by sensor, displayed on controller.
K	Kelvin, temperature difference
min	Minutes
Set point value	Temperature which is to reach by the controller

Note:

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